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MATHEMATICAL PHYSICS.—*On the application of Appell's equations.*[1] MARGARET WHEELER, Washington, D. C. (Communicated by EDGAR W. WOOLARD).

Both Lagrange's equations and Appell's equations describe the motion of a body or system of bodies. The latter are the more general in that they may be applied directly to non-holonomic, as well as holonomic, systems; a system being holonomic when the number of degrees of freedom is the same as the least number of distinct coördinates, and non-holonomic when the number of degrees of freedom is less than the least number of distinct coördinates. But this advantage of Appell's equations is merely theoretical since Lagrange's equations may easily be modified to apply to non-holonomic problems. Moreover, the mathematical difficulties in the application of Appell's equations to simple holonomic problems make them less useful. The question arises as to whether Appell's equations have any practical advantages at all. There is one, viz., their application to holonomic systems with cyclic coördinates.

Suppose we have a holonomic, dynamic system of n particles whose motion may be described by k distinct coördinates represented by q_κ ($\kappa = 1, 2, \ldots, k$). Define $T \equiv \sum_{i=1}^{n} \frac{m_i}{2}\left[\dot{x}_i^2 + \dot{y}_i^2 + \dot{z}_i^2\right]$. Then Lagrange's equations may be written:

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\partial T}{\partial \dot{q}_\kappa}\right) - \frac{\partial T}{\partial q_\kappa} = Q_\kappa$$

The "energy of accelerations" is defined as $S \equiv \sum_{i=1}^{n} \frac{m_i}{2}\left[\ddot{x}_i^2 + \ddot{y}_i^2 + \ddot{z}_i^2\right]$

[1] Received January 27, 1932.

and we write Appell's equations as

$$\frac{\partial S}{\partial \ddot{q}_\kappa} = Q_\kappa \quad \text{or} \quad \frac{\partial S'}{\partial \ddot{q}_\kappa} = Q_\kappa$$

where S' includes only the terms in S involving the accelerations. The Q_κ's are determined by computing the virtual work, $Q_\kappa \delta q_\kappa$. Since both Lagrange's and Appell's equations apply directly to holonomic systems, we have the identity

$$\frac{\partial S'}{\partial \ddot{q}_\kappa} \equiv \frac{\mathrm{d}}{\mathrm{d}\,t}\left(\frac{\partial T}{\partial \dot{q}_\kappa}\right) - \frac{\partial T}{\partial q_\kappa} = Q_\kappa$$

A cyclic coördinate is defined as one which does not appear explicitly in T; that is, it appears only in its derivatives. Suppose there are l cyclic coördinates leaving $k - l$ non-cyclic coördinates. The condition for a cyclic coördinate in T may be stated as $\frac{\partial T}{\partial q_\lambda} = 0$, ($\lambda = 1, 2, \ldots, l$). Then the above identity reduces to

$$\frac{\partial S'}{\partial \ddot{q}_\lambda} \equiv \frac{\mathrm{d}}{\mathrm{d}\,t}\left(\frac{\partial T}{\partial \dot{q}_\lambda}\right)$$

Let p_λ represent the momentum of a cyclic coördinate. Then since $\frac{\partial T}{\partial \dot{q}_\lambda} = p_\lambda$, $\frac{\partial S'}{\partial \ddot{q}_\lambda} = \dot{p}_\lambda$. For holonomic systems $\frac{\partial S'}{\partial \ddot{q}_\lambda}$ will always be integrable since it is identical with $\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\partial T}{\partial \dot{q}_\lambda}\right)$. In order to identify a cyclic coördinate in S' we define it as one which does not appear explicitly in S' and then show that this definition is equivalent to the definition for a cyclic coördinate in T.

Whether or not a coördinate be cyclic depends upon how the Cartesian coördinates are expressed in terms of the generalized coördinates. When the Cartesian coördinates are expressed as rational, algebraic functions of the generalized coördinates, it is easily seen by inspection that a coördinate will be cyclic in both T and S' when the relationship is linear and non-cyclic in both for cases of higher degree. We find by trial that it is impossible to obtain a cyclic coördinate in T or S' for a logarithmic or exponential function unless the latter be expressed as a particular trigonometric function. We shall now consider this case.

Let $$x = a \sin q$$

Then $$\dot{x} = a \cos q \, \dot{q}$$

$$\ddot{x} = a \cos q \, \ddot{q} - a \sin q \, \dot{q}^2$$

It is evident that $\ddot{x}$ and $\ddot{x}^2$ will always contain the coördinates for any function of this type. Consider the case, however, when

$$x = a \sin q$$

$$y = a \cos q$$

$$z = 0$$

We obtain the following expressions for T and S':

$$T = \frac{m}{2} [a^2 \dot{q}^2 (\sin^2 q + \cos^2 q)] = \tfrac{1}{2} m a^2 \dot{q}^2$$

$$S' = \frac{m}{2} [a^2 \ddot{q}^2 (\sin^2 q + \cos^2 q)] = \tfrac{1}{2} m a^2 \ddot{q}^2$$

This is probably the only way in which we may obtain a cyclic coördinate for a trigonometric function; that is, by the combination of (sine)^2 and (cosine)^2 terms. The function above is very simple, but we find that we obtain a cyclic coördinate for complex functions provided the cyclic coördinate bears the same relationship to x, y, and z. For example, q_1 will be cyclic in T and S' if

$$x_i = f(q_2, q_3, \ldots, q_k) \sin q_1$$

$$y_i = g(q_2, q_3, \ldots, q_k) \cos q_1$$

$$z_i = h(q_2, q_3, \ldots, q_k)$$

Since a coördinate is cyclic in S' when it is cyclic in T for all these representative functions, we conclude that our definitions of a cyclic coördinate in T and S' are equivalent.

The greatest advantage of the use of a cyclic coördinate is found in the case of ignorable coördinates, a special type of cyclic coördinate obtained when $Q_\lambda \delta q_\lambda$ vanishes. This is true when $Q_\lambda = 0$. For a cyclic coördinate $\dfrac{\partial S'}{\partial \ddot{q}_\lambda} \equiv \dot{p}_\lambda = Q_\lambda$ and p_λ is constant for an ignorable

coördinate. For Lagrange's equations Routh has introduced a modified function by which we may ignore those coördinates having constant momenta. Routh's modified function is

$$M \equiv T_p - \sum_{\lambda=1}^{l} p_\lambda \dot{q}_\lambda$$

where T_p is a function of the coördinates and the momenta. Suppose that all the cyclic coördinates are ignorable. Then we may substitute the constant values of the momenta, a_λ, for p_λ.

$$M \equiv T_p - \sum_{\lambda=1}^{l} a_\lambda \dot{q}_\lambda$$

Let $\mu = l+1, l+2, \ldots, k$, since there are $k-l$ non-cyclic coördinates. Then the equations of motion for the non-cyclic coördinates in terms of the modified function are

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\partial M}{\partial \dot{q}_\mu}\right) - \frac{\partial M}{\partial q_\mu} = Q_\mu$$

Thus we have reduced the number of equations to be solved simultaneously from k to $k-l$.

In Appell's equations, S' is a function of all the velocities, accelerations, and non-cyclic coördinates. We have $2l$ equations expressing p_λ and $\dot{p}_\lambda$ in terms of the coördinates, velocities and accelerations. Therefore, we may express the l cyclic velocities and the l cyclic accelerations in terms of the cyclic momenta and non-cyclic coördinates, velocities and accelerations. When we substitute for $\ddot{q}_\lambda$ and $\dot{q}_\lambda$ in S', we represent the new function by S'_p. Then

$$\frac{\partial S'_p}{\partial \ddot{q}_\mu} = \frac{\partial S'}{\partial \ddot{q}_\mu} + \sum_{\lambda=1}^{l} \frac{\partial S'}{\partial \ddot{q}_\lambda}\frac{\partial \ddot{q}_\lambda}{\partial \ddot{q}_\mu} \qquad \begin{matrix} \lambda = 1, 2, \cdots, l \\ \mu = l+1, l+2, \cdots, k \end{matrix}$$

$$\frac{\partial S'}{\partial \ddot{q}_\lambda} = \dot{p}_\lambda$$

$$\frac{\partial S'}{\partial \ddot{q}_\mu} = \frac{\partial S'_p}{\partial \ddot{q}_\mu} - \sum_{\lambda=1}^{l} \dot{p}_\lambda \frac{\partial \ddot{q}_\lambda}{\partial \ddot{q}_\mu}$$

$$\frac{\partial S'}{\partial \ddot{q}_\mu} = \frac{\partial}{\partial \ddot{q}_\mu}\left(S'_p - \sum_{\lambda=1}^{l} \dot{p}_\lambda \ddot{q}_\lambda\right)$$

Define $$N \equiv S'_p - \sum_{\lambda=1}^{l} \dot{p}_\lambda \ddot{q}_\lambda$$

$$\frac{\partial S'}{\partial \ddot{q}_\mu} = \frac{\partial N}{\partial \ddot{q}_\mu}$$

Appell's equations for the non-cyclic coördinates become $\frac{\partial N}{\partial \ddot{q}_\mu} = Q_\mu$, and we call N the modified function for Appell's equations.

For the cyclic coördinates we obtain two equations for each coordinate.

$$\frac{\partial S'_p}{\partial \dot{p}_\lambda} = \frac{\partial S'}{\partial \ddot{q}_\lambda}\frac{\partial \ddot{q}_\lambda}{\partial \dot{p}_\lambda} = \dot{p}_\lambda \frac{\partial \ddot{q}_\lambda}{\partial \dot{p}_\lambda}$$

$$\frac{\partial S'_p}{\partial \dot{p}_\lambda} = \frac{\partial}{\partial \dot{p}_\lambda}(\dot{p}_\lambda \ddot{q}_\lambda) - \ddot{q}_\lambda$$

$$\ddot{q}_\lambda = -\frac{\partial}{\partial \dot{p}_\lambda}\left(S'_p - \sum_{\lambda=1}^{l} \dot{p}_\lambda \ddot{q}_\lambda\right)$$

$$\left.\begin{aligned} \ddot{q}_\lambda &= -\frac{\partial N}{\partial \dot{p}_\lambda} \\ \dot{p}_\lambda &= Q_\lambda \end{aligned}\right\} \text{the two equations for each coördinate}$$

In Routh's modified function we have p_λ while in N we have $\dot{p}_\lambda$. We find a distinct advantage here for ignorable coördinates since $\dot{p}_\lambda = 0$ and N, therefore, reduces to S'_p. To illustrate the advantage we may apply this to a free particle in a plane as follows:

$$x = r\cos\theta$$

$$y = r\sin\theta$$

$$T = \frac{m}{2}[\dot{r}^2 + r^2\dot{\theta}^2]$$

$$S' = \frac{m}{2}[\ddot{r}^2 - 2r\ddot{r}\dot{\theta}^2 + r^2\ddot{\theta}^2 + 4r\dot{r}\dot{\theta}\ddot{\theta}]$$

We see that θ is cyclic in both T and S'. Now suppose the force perpendicular to r vanishes so that we may ignore θ. Then by Routh's modified function we obtain

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\partial T}{\partial \dot{\theta}}\right) \equiv \frac{\mathrm{d}}{\mathrm{d}t}\, p_\theta = \frac{\mathrm{d}}{\mathrm{d}t}\,(mr^2\dot{\theta}) = 0 \qquad \text{since } \frac{\partial T}{\partial \theta} \equiv 0$$

$$mr^2\dot{\theta} = a \text{ (a constant)}$$

$$\dot{\theta} = \frac{a}{mr^2}$$

$$T_p = \frac{m}{2}\left[\dot{r}^2 + \frac{a^2}{m^2r^2}\right]$$

$$M \equiv T_p - p_\theta\dot{\theta} = \frac{m}{2}\left[\dot{r}^2 - \frac{a^2}{m^2r^2}\right]$$

$$\frac{\partial M}{\partial \dot{r}} \equiv M\dot{r} \qquad\qquad \frac{\partial M}{\partial r} \equiv \frac{a^2}{mr^3}$$

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\partial M}{\partial \dot{r}}\right) - \frac{\partial M}{\partial r} \equiv m\ddot{r} - \frac{a^2}{mr^3}$$

Let $R \equiv$ force along the radius.

$$m\ddot{r} - \frac{a^2}{mr^3} = R$$

We obtain the same equation by using the function N as follows:

$$\frac{\partial S'}{\partial \dot{\theta}} \equiv \dot{p}_\theta = mr^2\ddot{\theta} + 2mr\dot{r}\dot{\theta} = 0$$

$$p_\theta = mr^2\dot{\theta} = a$$

$$\dot{\theta} = \frac{a}{mr^2} \qquad\qquad \ddot{\theta} = -\frac{2\dot{r}a}{mr^3}$$

$$N \equiv S'_p = \frac{m}{2}\left[\ddot{r}^2 - \frac{2\ddot{r}a^2}{m^2r^3} + \frac{4\dot{r}^2a^2}{m^2r^4} - \frac{8\dot{r}^2a^2}{m^2r^4}\right]$$

$$\frac{\partial N}{\partial \ddot{r}} \equiv m\ddot{r} - \frac{a^2}{mr^3} = R$$

The process is shortened in comparison to Routh's method since $N \equiv S'_{\dot{p}}$.

We may also compare the advantages of Appell's and Lagrange's equations in the case of a cyclic system. A cyclic system in T is defined as one for which T may be represented approximately by a homogeneous, quadratic function of the cyclic velocities. In the case of a free particle in a plane, θ is cyclic and r is non-cyclic in T, for

$$T = \tfrac{1}{2}\, m\, [\dot{r}^2 + r^2\dot{\theta}^2]$$

If we suppose that $\dot{r}$ is small enough so that $\dot{r}^2$ may be neglected in comparison with $r^2\dot{\theta}^2$ we obtain $T_\lambda = \tfrac{1}{2}\, mr^2\dot{\theta}^2$ where $T_\lambda \equiv$ cyclic system in T.

Lagrange's equations for a cyclic system become

$$-\frac{\partial T_\lambda}{\partial q_\mu} = Q_\mu$$

$$\frac{d}{dt}\left(\frac{\partial T_\lambda}{\partial \dot{q}_\lambda}\right) = Q_\lambda$$

For the above system we have

$$-\frac{\partial T_\lambda}{\partial r} \equiv -\, mr\dot{\theta}^2 = R$$

$$\frac{d}{dt}\left(\frac{\partial T_\lambda}{\partial \dot{\theta}}\right) \equiv \frac{d}{dt}\,(mr^2\dot{\theta}) = r\Theta$$

To obtain a cyclic system of the same type as above for Appell's equations we must neglect any term in S' containing only $\ddot{r}$. We find, if $S'_\lambda \equiv$ cyclic system in S', the following:

$$S'_\lambda = \frac{m}{2}\,[2r\ddot{r}\dot{\theta}^2 + r^2\ddot{\theta}^2 + 4r\dot{r}\dot{\theta}\ddot{\theta}]$$

$$\frac{\partial S'_\lambda}{\partial \ddot{r}} \equiv -\, mr\dot{\theta}^2 = R$$

$$\frac{\partial S'_\lambda}{\partial \ddot{\theta}} \equiv \frac{d}{dt}\,(mr^2\dot{\theta}) = r\Theta$$

We see that these equations are identical with those obtained by a cyclic system in Lagrange's equations. There are two cases in which the two approximations would be identical; namely, when r is constant and $\dot{r} = \ddot{r} = 0$, or when $\dot{r}$ is constant and very small so that $\ddot{r} = 0$. Since $\dot{r}$ must always be small even though not constant, it could vary over only a small range so that $\ddot{r}$ would have to be small. However, $\ddot{r}$ would not necessarily be of the same order of magnitude as $\dot{r}$.

Lagrange's equations, without doubt, have an advantage over Appell's equations for obtaining the equations of motion of a system. But this is only the first step in problems of dynamics. Far more difficult is the second one—integrating them. Cyclic and ignorable coördinates aid in the integration by the reduction of the number of equations to be solved simultaneously, and we have found that they are as readily recognized in the S' function as in the T function. Furthermore, we have seen that we need to compute only $S'_p \equiv N$ in place of the complete modified function for ignorable coördinates so that it is really easier to apply Appell's equations than Lagrange's equations in this case.

For the opportunity to do this work the writer is indebted to a Sanders Fellowship in Physics at The George Washington University.

BOTANY.—*A new species of* Adenostegia *from Death Valley, with notes on calyx structure in the genus.*[1] C. V. MORTON, U. S. National Museum. (Communicated by FREDERICK V. COVILLE).

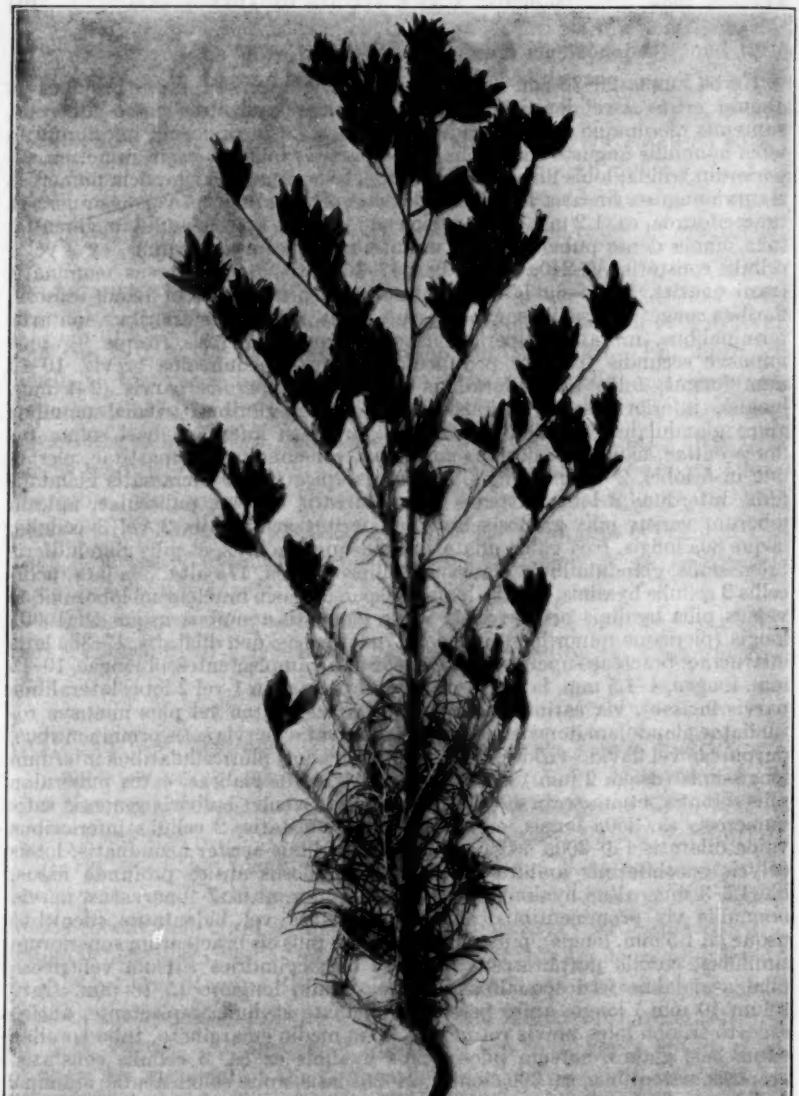
Dr. Frederick V. Coville, botanist of the Death Valley Expedition, 1891, revisited that locality in the interest of the National Geographic Society in April, and again in September, 1931. Among the plants of his recent collection is a species of *Adenostegia* (Scrophulariaceae), which is here described as new. A revision of this genus was published in 1918 by Mrs. Roxana Stinchfield Ferris, of Stanford University,[2] and most of the specimens in the U. S. National Herbarium are annotated by Mrs. Ferris. All species of the genus are there represented, most of them by material of the type collections. The plant collected by Dr. Coville may be described as follows:

[1] Published by permission of the Secretary of the Smithsonian Institution. Received February 5, 1932.

[2] "Taxonomy and distribution of *Adenostegia*," Bull. Torrey Club **45**: 399–423, *pl. 10-12*. 1918.

Adenostegia eremica Coville & Morton, sp. nov.

Herba annua 20–30 cm. alta, valde sed stricte ramosa, ramis brevibus ex angulo acuto ascendentibus, inferioribus dense purpureo-griseo-puberulis, supremis plerumque flavido-viridibus; folia ad basin ramorum inferiorum in lobis nonnullis anguste linearibus valde partita, folia ad basin ramorum superiorum trifida, lobis linearibus revolutis, folia ramorum simplicia numerosa recurva anguste linearia 10–30 mm. longa, apicem ramorum versus minora et bracteiformia, ca. 1.2 mm. lata, perspicue revoluta, apice glandulam gerentia, folia omnia dense puberula, pilis minutis apice recurvis hyalinis, ex 2 vel 3 cellulis constatis, 80–240μ longis, basi 17–30μ latis, apicem versus acuminatis (raro acutis), hic 4–6μ latis; inflorescentia spicata, rhachi haud ramosa, floribus congestis sessilibus, capitulis 1–8-floris, in ramis inferioribus solitariis terminalibus, in ramis superioribus plerumque numerosis (usque 9), plus minusve secundis (propter pedunculos tortiles); pedunculus brevis, 10–15 mm. longus, foliis bracteiformibus numerosis puberulis parvis (2–4 mm. longis), inferioribus simplicibus linearibus, superioribus trifidis, omnibus apice glandulam gerentibus instructus; bracteae inferiores basi solum inflorescentiae, haud cum floribus adspersae, concinne palmatipartitae, pleraeque in 5 lobis, 2–7 mm. longis, linearibus apice paullo incrassatis glanduliferis, interdum 2 lobis extremis semel furcatis divisae, puberulae, apicem loborum versus pilis granosis brevibus acriter acuminatis 2 vel 3 cellulis, usque 80μ longis, basi valde dilatatis hic usque 56μ latis, et pilis glanduliferis brevissimis, glandula lutea transverse ellipsoidea ca. 17μ alta, 35μ lata, pedicellis 2 cellulis hyalinis, 20–25μ longis adspersis, basin bractearum loborumque versus pilis hyalinis nec granosis valde elongatis tenuibus usque ad 1090μ longis (plerisque minoribus), apice ca. 7μ latis, basi non dilatatis, 17–36μ latis instructae; bracteae superiores, id est, eae flores amplectentes, oblongae, 10–15 mm. longae, 4–4.5 mm. latae, integrae (vel perraro in 1 vel 2 lobis lateralibus parvis incisae), vix carinatae saccataeve, apice acutae vel plus minusve rotundatae glandulam dorsalem gerentes, 5-nervatae nervis satis prominentibus, purpureae vel flavido-virides, ciliatae, pilis hyalinis pluricellularibus interdum longissimis (usque 2 mm.) basi non dilatatis, intus glabrae, extus puberulae pilis minutis, etiam scabrae pilis (praecipue in venis) bulbosis granosis satis numerosis ca. 350μ longis, ex ca. 4 cellulis constatis, 2 cellulis inferioribus valde dilatatis 140–200μ latis, cellulis terminalibus acriter acuminatis; lobus calycis spathiformis ambitu lanceolatus tubulosus antice profunde fissus, hic 1.5–3 mm. altus hyalinus, postice 10–15 mm. altus 7–9-nervatus, nervis nonnullis vix prominentibus, apice emarginatus vel bidentatus (dentibus usque ad 1.5 mm. longis), puberulus et scaber, pilis eis bractearum superiorum similibus; corolla purpurascens tubulosa basi cylindrica sursum ventricosa bilabiata, labiis fere aequalibus, postico paullo longiore 15–18 mm. (raro solum 10 mm.) longo, apice perspicue uncinato stylum amplectente, antico saccato trilobo lobis brevis rotundatis, lobo medio emarginato, tubo corollae extus basi glabro, sursum piloso, pilis hyalinis ex ca. 3 cellulis constatis, granosis, patentibus, ca. 300μ longis, 21–25μ latis, apice solum acutis; stamina 4 didyma, filamentis liberis in medio corollae insertis dense albido-pilosis, antheris 2-locularibus, loculo superiore majore, 1.2–1.5 mm. longo, perspicue ciliato, loculo inferiore divergente minore sed non abortivo ciliato; stylus glaber apice acriter uncinatus breviter exsertus; ovarium glabrum apice acutum; capsula membranacea glabra apice acuta ca. 9.5 mm. longa; semina in capsula ca. 14, oblonga vel obovata, ca. 2 mm. longa, 1 mm. lata, in tota superficie arcte et perspicue favosa.



ADENOSTEGIA EREMICA Coville & Morton, sp. nov. (Type specimen; one-half natural size).

Type in the U. S. National Herbarium, no. 1,530,679, collected near the crest of the Panamint Mountains, at the head of Death Valley Canyon, California, altitude about 3,000 meters, September 18, 1931, by Frederick V. Coville and Arthur F. Gilman (no. 58). Duplicates of this collection have been presented to the Philadelphia Academy of Sciences and the New York Botanical Garden.

Additional collections are as follows: (1) Near the crest of the Panamint Mountains, at the head of Hanaupah Canyon, opposite Thorndyke's Camp, California, altitude about 2,800 meters, September 17, 1931, by F. V. Coville and A. F. Gilman (no. 57); duplicates of this have been sent to Professor W. L. Jepson, Professor LeRoy Abrams, and the Santa Barbara Museum of Natural History; (2) Death Valley slope of the divide between Wild Rose Canyon and Hanaupah Canyon, Death Valley, California, altitude about 2,800 meters, September 15, 1931, by Coville and Gilman (no. 28); a duplicate of this has been sent to the Gray Herbarium.

A preliminary study of Dr. Coville's collection from Death Valley brought to light at once several interesting facts. Mrs. Ferris divides the genus into six sections. Excluding the sections *Anisocheila*, *Pringlea*, and *Dicranostegia*, which do not concern us, we are left with the three sections *Euadenostegia*, *Kingia*, and *Chloropyron*. These are separated in the key to sections as follows:

Calyx diphyllous.....III. *Euadenostegia.*
Calyx monophyllous
.....
Inflorescence capitate.....IV. *Kingia.*
Inflorescence spicate.....VI. *Chloropyron.*
.....

In the first place it may be definitely stated that between *Kingia* and *Chloropyron* there is no difference in the inflorescence, which obviously is spicate in both cases. A more troublesome question arises with respect to the structure of the calyx. Dissection of *A. kingii* shows that the flower possesses a single calyx lobe of a spathaceous type on the posterior side; this lobe, which is deeply bidentate at apex, is nearly as long as the corolla and is sharply cut down anteriorly to a short tube scarcely two millimeters high. Thus the calyx is definitely tubular at base, the anterior portion being very short and hyaline. Originating directly below and partially surrounding this calyx is a bract, similar in texture and size but lobed toward the summit.

This, then, is the structure described as "calyx monophyllous." It was surprising therefore to find, on dissecting a flower of *A. wrightii*, a species placed in the section *Euadenostegia*, identically the same structure, a single spathaceous calyx lobe partially surrounded at base by a lobed bract. Yet the outer bract in this case is considered by Mrs. Ferris as a lower calyx lobe and described as " . . . tip lanceolate or two- to four-toothed." Examination of a series of specimens shows, however, that this outer bract is sometimes entire and sometimes (on the same plant) 3–5-lobed, the lobing being of exactly the same type as in *A. kingii*, and consisting of a splitting away

of the parallel veins as they approach the apex. Each lobe therefore consists of a central vein and a varying amount of surrounding leaf tissue. Since there are five veins in each bract there can never be more than five lobes; three appears to be the commonest number.

Other species of the section *Euadenostegia* were next examined. They were all found to be of essentially the same structure, the outer bract surrounding the spathaceous calyx being usually entire. The distinctions between the sections as given by Mrs. Ferris are therefore illusory, the calyx being monophyllous in all cases. These dissections showed at once that the section *Kingia* has no distinctive characters, the species *A. kingii* being in fact exceedingly close to *A. wrightii*.

The case of the section *Chloropyron* is also remarkable. In the species included in this section the upper calyx lobe is not tubular at base but is very similar to the entire bract inserted on the opposite side just below it. This structure of the calyx and bract might much more reasonably be regarded as "diphyllous" than that in any of the sections of the genus, yet the species constituting this section have been described from the time of Asa Gray as "monophyllous," which is undoubtedly true. This circumstance illustrates the general misunderstanding of the genus by authors.

The genus was first proposed as *Adenostegia* by Bentham,[3] the calyx of his single species, *A. rigida*, being described as "bifidus." Ten years later Bentham included the genus in his treatment of the Scrophulariaceae for the Prodromus.[4] His description of the calyx reads: "Calyx bipartitus segmentis integris, bracteis 4 incisis suffultus (vel 4-partitus bibracteatus?) . . . Bracteae cum calycis laciniis 6, per para imbricatae, 2 exteriores (certe bracteae) trifidae foliis floralibus similes, 2 intermediae (an bracteae, an calycis segmenta?) integrae bifidae vel exterioribus consimiles, 2 intimae (calycis segmenta) acute acuminatae lanceolatae carinatae concavae, 7–8 lin. longae."

However, in the "Addenda et Corrigenda"[5] Bentham changes the name of the genus to *Cordylanthus* Nutt. (Mss.) and describes four species: *C. filifolius* Nutt.(=*Adenostegia rigida* Benth.), *C. ramosus* Nutt., *C. capitatus* Nutt., and *C. maritimus* Nutt. The description of the calyx of *Cordylanthus* is as follows: "Calyx bipartitus, segmentis complicatis integris vel postico breviter bifido." Under *C. maritimus* he says, ". . . calycis lobo postico brevissime bifido." This latter statement indicates than Bentham did not consider the calyx of *C. maritimus* essentially different from that of the other species.

Asa Gray, however, in his revision of *Cordylanthus*[6] separated the genus into two sections, *Adenostegia* and *Hemistegia*, the first said to be ". . .

[3] Bentham in Lindley, Nat. Syst. ed. II, 445. 1836.
[4] Bentham in DC. Prodr. 10: 537. 1846.
[5] DC. Prodr. 10: 597. 1846.
[6] Proc. Amer. Acad. 7: 383. 1868.

calyx diphyllous," the latter "calyx monophyllous. . . ." This imaginary distinction has been kept up by authors since Gray, including Wettstein,[7] who gives a very brief treatment of the genus based wholly on that of Gray's Synoptical Flora. In Fig. 43, J. and K, Wettstein gives an illustration of the flower of "*Cordylanthus Nevinnyi* [sic!] A. Gr." This drawing is so inaccurate that it seems impossible that the artist could have had a specimen of the species, *nevinii*, before him.

Professor Jepson's descriptions[8] of the species of this genus indicate that he regards the calyx as consisting of one lobe only. Thus he describes the calyx of *C. capitatus*, "calyx cleft to base anteriorly, 2-nerved, 2-cleft at apex posteriorly . . .," and of *C. nevinii*, "calyx tubular at base or obliquely cleft or parted on the anterior side nearly to base. . ." Moreover, his key departs from all previous keys to the species in not separating the subgenera by the character of the calyx being mono- or di-phyllous. On the other hand, in his key to the genera of Scrophulariaceae he separates *Cordylanthus* from *Castilleia* and *Orthocarpus* as follows: "Calyx of 2 distinct divisions, or the upper division wanting." It is, of course, impossible ever to consider the *upper* division as wanting.

Adenostegia eremica may be distinguished from related species by the following key:

Individual flowers bracteolate..... **A. ramosa, A. rigida,** and others.
Individual flowers not bracteolate
Sterile bracts at base of inflorescence several
Sterile bracts symmetrically parted into comparatively broad lobes.
Inner bracts (i.e. those subtending flowers) entire..... **A. eremica.**
Inner bracts conspicuously and symmetrically lobed..... **A. helleri.**
Sterile bracts irregularly parted into filiform lobes; inner bracts entire or irregularly lobed..... **A. wrightii.**
Sterile bract at base of inflorescence solitary or absent, irregularly dissected into filiform lobes; inner bracts irregularly lobed.. **A. kingii.**

The species may be separated also by the following key based on the pubescence.

Hairs on leaves not glandular, dense, recurved, 80–240μ long, 17–30μ wide at base, acuminate at apex, here 4–6μ wide; calyx and subtending bract scabrous, the hairs bulbous, granular, about 350μ long, the two lower cells dilated 140–200μ wide, the two terminal acuminate... **A. eremica.**
Hairs on leaves glandular at least in part; calyx and subtending bract without scabrous hairs.
Leaves (and whole plant) densely glandular, the glandular hairs with a 4-celled stalk, this about 70μ wide at base (tapering to the apex where

[7] Wettstein in Engl. & Prantl, Pflanzenfam. IV. 3b: 98. 1895.
[8] W. L. Jepson, Manual of the flowering plants of California. 1925.

25μ wide), and 240–500μ long; terminal yellow gland about 50μ wide.....**A. helleri.**

Leaves less conspicuously glandular, the stalk usually 3-celled, not over 35μ wide at base, not over 130μ long, the terminal gland not over 35μ wide.....**A. kingii and A. wrightii.**

BOTANY.—*A new* Dryopteris *from Cuba.*[1] CARL CHRISTENSEN, Botanisk Museum, Copenhagen.

Some time ago I received on loan from the U. S. National Museum, through Dr. William R. Maxon, several specimens of an interesting Cuban fern (*Dryopteris*), with the request that if it proved to be new, as Dr. Maxon believed, I should describe it, because of my special interest in the American species of this large genus. I did find it new, and offer here a description:

Dryopteris Santae Clarae C. Chr., sp. nov.

Ctenitis, e sectione *D. hirta*, ab speciebus omnibus hujus sectionis differt: lamina basin versus sensim angustata (pinnis infimis 3–4 cm. longis) ubique dense glanduloso-pubescente; indusio parvo.

Rhizome oblique or decumbent, densely clothed with linear-lanceolate or lanceolate, long, acuminate, entire, castaneous scales. Stipe variable in length, usually 10–12 cm. long, densely crinite by narrow long hair-pointed scales (about 2 mm. long). Lamina lanceolate, 30–50 cm. long, 15–20 cm. broad at middle, narrowed toward both ends, herbaceous, densely glandulose-pubescent throughout by short pale glands and long articulated pale thin hairs (the hairs of rachis, costae, and veins rather longer, very soft), bipinnate-pinnatifid; rachis crinite like the stipe, but the scales much fewer; pinnae 12–15 pairs, subsessile, alternate, the basal ones 3–4 cm. long, the following ones (at distances of 5–6 cm.) gradually larger, the middle ones the largest, these 10–11 cm. long, 2.5–3 cm. wide, lanceolate, acuminate; pinnules in 15–18 pairs, the lower ones short-petiolulate, the upper adnate to costa and decurrent, the largest 2 cm. long, 1 cm. broad at base, deltoid, nearly pinnate at base (segments deeply pinnatifid), the middle ones 5 mm. broad at base, tapering toward the acute apex, incised nearly to the midrib into oblique, oblong, dentate or repand lobes; costae and costules furnished beneath with a few small, light brown, ovate-lanceolate, sometimes subbullate scales; veins oblique, not reaching the margin; sori supramedial, a little below the tip of the vein; indusia small, brown, subpersistent.

Type in the U. S. National Herbarium, no. 1,301,333, collected at La Siguanea, mountains of the Siguanea-Trinidad group, Province of Santa Clara, Cuba, on shaded perpendicular cliffs, February 14, 1924, by E. L. Ekman (no. 18462). The following additional specimens, all from the Province of Santa Clara, are at hand: Trinidad Mountains, alt. 470–1,050 meters, *Britton & Britton* 5101; *Britton & Wilson* 5298; *Jack* 7040, 7108, 7238, 7885; San Blas, alt. 180–240 meters, *Jack* 6508.

This new species of the group of *D. hirta*, which is very rich in forms in Hispaniola and Cuba, differs chiefly from the other West Indian species by

[1] Received February 15, 1932.

its leaf being considerably and gradually narrowed below. From its nearest relative, *D. nemorosa* (Willd.) Urban, it differs further in its dense pubescence, smaller indusia, and few bullate scales, or the scales sometimes wanting. Like other species of this group, it seems to be local.

BOTANY.—*Marine algae from the islands of Panay and Negros (Philippines) and Niuafoou (between Samoa and Fiji).*[1] MARSHALL A. HOWE, New York Botanical Garden. (Communicated by WILLIAM R. MAXON.)

In April, 1931, Dr. William R. Maxon, Associate Curator, Division of Plants, of the United States National Museum, sent to the writer small collections of algae made by Lieut. H. C. Kellers, M. D., of the Medical Corps of the United States Navy, who was attached as surgeon to the Naval Eclipse Expeditions of 1929 and 1930. The specimens of algae, though excellent and well preserved with the aid of alcohol, were evidently incidental to more extensive collections of insects, reptiles, fishes, birds, amphibians, mammals, mollusks, echinoderms, corals, and other marine invertebrates, all of much scientific interest, as indicated in a preliminary way in the annual reports of the United States National Museum for the years 1930 and 1931.

Scattered references to the algae of the Philippine Islands have appeared in the earlier phycological literature. Blanco, in the two editions of his "Flora de Filipinas," 1837 and 1845, describes a dozen or more species of algae, more or less recognizable, using for the most part previously existing names, without citation of authorities. More comprehensive was the report of G. von Martens on the algae of "Die Preussische Expedition nach Ost-Asien"[2] in 1866, in which 75 species were listed as occurring in the Philippines, including four from freshwater.

Dickie,[3] in a report on the algae of the Expedition of H. M. S. *Challenger*, enumerates 47 species from the Philippines.

Piccone[4] lists 9 species from the island of Ticao and 9 from Luzon (Cavite). A later paper by the same author[5] adds 2 species and one variety to this list.

In 1911, Dr. E. D. Merrill, then botanist of the Bureau of Science at Manila, forwarded to the present writer for determination a col-

[1] Received for publication March 2, 1932.

[2] Bot. Theil.

[3] Journ. Linn. Soc. Bot. **15**: 242–246. 1876.

[4] Alghe del viaggio di circumnavigazione della Vettor Pisani, 89, 90. 1886.

[5] Nuove alghe del viaggio di circumnavigazione della "Vettor Pisani." Mem. Reale Accad. d. Lincei IVa. **6**: 53. 1889.

lection of 229 numbers of Philippine algae, collected by himself, Dr. W. R. Shaw, and others. After studying and reporting upon a part of this collection, the writer, then engaged in a study of the marine algae of the West Indies and Peru, asked permission to turn the col-

CHAETOMORPHA KELLERSII M. A. HOWE, sp. nov. (Type specimen; natural size.)

lection over to Mr. F. S. Collins, who was then working on the algae of the Philippines as represented in collections made by naturalists of the United States Fish Commission attached to the S. S. *Albatross*.

Later, Dr. Merrill sent approximately 300 specimens directly to Mr. Collins. Mr. Collins, at his death in 1920, left a manuscript on the Philippine algae that was nearly ready for publication, and this came into the possession of The New York Botanical Garden with Dr. N. L. Britton's purchase of the Collins algal herbarium in 1922 and his donation of it to the Garden. In October, 1928, this Philippine manuscript was turned over to Professor William Albert Setchell of the University of California, who with a Mr. Manza, a Filipino student, was then preparing to make a special study of the marine algae of the Philippine Islands. The following list of 21 species from Panay and Negros islands is to be looked upon as a modest contribution to the more extended treatise that is to be expected from the University of California.

I. ALGAE COLLECTED ON PANAY ISLAND, PHILIPPINE ISLANDS, BY LIEUT. H. C. KELLERS, 1929

CHLOROPHYCEAE

ENTEROMORPHA LINGULATA J. Ag.

Chaetomorpha Kellersii M. A. Howe, sp. nov. FIGURE 1.

Filamentis longis fuscis liberis plus minusve tortis et intricatis, 200–450μ crassis, ad septa vulgo leviter constrictis, allantoideis, cellulis diametro 2–4 (–7)–plo longioribus, brevi-cylindricis aut subclavatis, saepe irregulariter constrictis vel subtortis, in siccitate saepe valde, interdum alternatim, collabentibus, parietibus modice tenuibus, maximam partem 3–18μ crassis.

A *Ch. Lino* (O. F. Muell.) Kuetz. in filamentis crassioribus fuscis, cellulis longioribus polymorphis plus collabentibus; a *Ch. torta* (Farl.) Yendo filamentis tenuioribus fuscis, cellulis longioribus polymorphis, etc., differt.

CAULERPA CLAVIFERA (Turn.) Ag.

CAULERPA MACRODISCA Decaisne

ACETABULARIA MAJOR Martens

PHAEOPHYCEAE

TURBINARIA CONOIDES (J. Ag.) Kütz.

PADINA DISTROMATICA Hauck

RHODOPHYCEAE

GALAXAURA FASTIGIATA Decaisne

GELIDIUM RIGIDUM (Vahl) Grev.

EUCHEUMA MURICATUM (S. G. Gmel.) Web.-v. Bosse

GRACILARIA COMPRESSA (Ag.) Grev.

GRACILARIA LICHENOIDES (L.) Grev.

ACANTHOPHORA ORIENTALIS J. Ag.

LITHOPHYLLUM sp., on *Gelidium rigidum*.

II. ALGAE COLLECTED ON NEGROS ISLAND (OCCIDENTAL), PHILIPPINE ISLANDS, BY LIEUT. H. C. KELLERS, APR. 20, 1929.

PHAEOPHYCEAE

SARGASSUM POLYCYSTUM Ag., var.
SARGASSUM SILIQUOSUM J. Ag.
DICTYOTA DICHOTOMA (Huds.) Lamour.
PADINA AUSTRALIS Hauck

RHODOPHYCEAE

HYPNEA MUSCIFORMIS (Wulf.) Lamour.
ACANTHOPHORA ORIENTALIS J. Ag.
SPYRIDIA FILAMENTOSA (Wulf.) Harv.
AMPHIROA FRAGILISSIMA (L.) Lamour.

III. ALGAE COLLECTED ON NIUAFOOU ISLAND, BY LIEUT. H. C. KELLERS, AUGUST-OCTOBER, 1930

Niuafoou[6] Island is a partly submerged volcanic crater in the Pacific Ocean in latitude 15° 33′ 55″ S. and longitude 175° 37′ 46″ W., and lying between Samoa and Fiji. "Good Hope Island" appears as a synonym on some of the maps. The name given to it by the discoverer, Captain Edwards, in 1791, is said to have been "Proby Island." It has also been nicknamed "Tin-can Island," from the method of delivering the infrequent mail by throwing it overboard in a sealed can from the visiting steamer. So far as is known to the writer, no algae have been previously reported from this island.

MYXOPHYCEAE

LYNGBYA MAJUSCULA (Dillw.) Harv.

CHLOROPHYCEAE

SIPHONOCLADUS INFESTANS Setch.
VALONIA AEGAGROPILA Ag. Sept. 14 and Oct. 12, 1930.
VALONIA FASTIGIATA Harv. Sept. 11 and 17, and Oct. 1 and 12.

PHAEOPHYCEAE

ECTOCARPUS sp., near *E. Mitchellae* Harv., on *Laurencia flexilis*.
SARGASSUM ANAPENSE Setch. & Gard. Sept. 29 and Oct. 1.
SARGASSUM CRISTAEFOLIUM Ag. Oct. 1, 2, and 4.
TURBINARIA ORNATA (Turn.) J. Ag.

RHODOPHYCEAE

ACTINOTRICHIA RIGIDA (Lamour.) Decaisne.
LAURENCIA FLEXILIS Setch. Aug. 26, Sept. 17, Oct. 1 and 16.
JANIA CAPILLACEA Harv.
AMPHIROA FRAGILISSIMA (L.) Lamour.

[6] Sometimes spelled Niuafoo, Niuafou, and Niuafu.

PALEOBOTANY.—*A new Oak* (Quercus perplexa) *from the Miocene of the western United States.*[1] EDWARD W. BERRY, Johns Hopkins University.

In 1902 Knowlton described the basal part of a leaf from the Mascall beds at Van Horn's ranch in the John Day basin (Grant County), Oregon, which, because it had an inequilateral base, he mistook for a leaflet of a compound leaf and named *Sapindus oregonianus.*[2]

Only this single type specimen was collected and no other specimens have ever been referred to in print. Some years ago Messrs. C. P. Ross and J. Heupgen collected a second specimen from the northwest corner of Section 19, Township 7 South, Range 46 East, near Richland, Baker County, Oregon (U. S. Geol. Survey Locality 7515). The latter came from light colored diatomaceous beds interbedded with Columbia lavas. It was submitted to the late Dr. Knowlton who identified it as *Sapindus oregonianus.* It is undoubtedly identical with the Mascall leaf to which that name was given, and shows three complete leaves, which I suppose Knowlton mistook for leaflets.

A glance at the accompanying illustration shows at once that this is not so, but that the specimen shows the distal portion of a very thick twig, and that the leaves are alternate in habit. This eliminates the genus *Sapindus* from further consideration although the venation is not very different from that of a number of forms from the western Miocene which have been referred to that genus.

The next question to decide is what genus these leaves do represent, and this is not an easy decision. I first looked through the associated Mascall species. Among these the only form at all similar to what was called *Sapindus oregonianus* is one Knowlton called *Salix perplexa.*[3] This is very similar in both form and venation, but tends to be somewhat smaller, more narrowly cuneate at the base, and more nearly equilateral, although the small leaf shown in Knowlton's figure 7 is quite inequilateral. Incidentally his figure 8 belongs to an entirely different species. It may be noted that one of the leaves of the present figured specimen is decidedly inequilateral, one is much less so, and the third is not at all inequilateral, thus showing that this feature is of no significance.

Knowlton compared his *Salix perplexa* with the existing *Salix bebbiana* of the northern Rocky Mountain region and elsewhere, but I can not see any such resemblance. The latter is frequently serrate,

[1] Received Feburary 8, 1932.

[2] F. H. KNOWLTON. U. S. Geol. Survey Bull. **204**: 79, p. 15, fig. 3. 1902.

[3] F. H. KNOWLTON. U. S. Geol. Survey Bull. **204**: 31, p. 2, figs. 5–8. 1902.

the secondaries are fewer and more ascending, and the twigs are pubescent or puberulent. Moreover it has conspicuous stipules, of which there are no traces in Knowlton's figure 5, or in the excellent specimen which is the subject of this note. The latter should certainly show traces of the stipules if they had ever been present, particularly as it is a terminal twig.

I am inclined to think that *Sapindus oregonianus* and *Salix perplexa* represent the same botanical Miocene species, but that it is not a *Salix*. It can not be a *Sapindus* because of the habit, and although the venation does not preclude such an identification it seems to me to be more like that in many entire leaves of the genus *Quercus*, although in the latter the secondaries are apt to be more widely spaced.

Figure 1. *Quercus perplexa* (Knowlton) Berry.

It seems ridiculous to describe a new oak from this region and horizon when one holds the often expressed conviction that there are already far more nominal species of *Quercus* than there were botanical species, and yet, in dealing with no other parts of the plants than leaves, I know of no other course, and it is justifiable if it is kept clearly in mind that all that is being done is recognizing a certain leaf-form which may have belonged to a botanical species with dimorphic or polymorphic foliage, like so many existing species in the west, southwest, and in Mexico.

The last mentioned region at the present time also affords justification for the assumption that, with the progressive aridity in parts of the west during the later Tertiary, new species came into existence,

many of which may have been the ancestors of the existing species of the Mexican plateau and of the Sierra Madre mountains which border it. Certainly a considerable number of species of Miocene *Quercus* have foliage closely comparable with existing Mexican species, and this has been pointed out in connection with the printed discussion of some of them.[4]

The new species, assuming that it comprises both what has been called *Salix perplexa* Knowlton and *Sapindus oregonianus* Knowlton, takes the specific name of the first of these, which not only has priority of position, but is fortified by the fact that the name *oregoniana* has already been used for a different species in the genus *Quercus*. The new species is therefore called *Quercus perplexa*, and may be redescribed as follows:

Quercus perplexa (Knowlton) Berry

Fig. 1.

Leaves of variable size, ranging from 2.25 to 5.5 centimeters in length, and from 1.2 to 2.5 centimeters in maximum width. Outline elliptical-lanceolate to ovate. Base cuneate, abruptly narrowed to the petiole, and frequently inequilateral. Apex usually cuspidate. Margins entire, more or less revolute. This is well shown on the right side of the largest and the left side of the smallest leaf here figured. Texture coriaceous. Petiole short and very thick, not over 5 millimeters in length. Midvein very stout and prominent proximad, conspicuously less so distad. Secondaries about 12 pairs, subparallel, rather straight, sometimes one of the secondaries will be dichotomous from near the base; they all diverge from the midvein at wide angles and are abruptly camptodrome well within the margins. Tertiaries camptodrome in the marginal regions, forming open polygonal meshes between the secondaries.

I have not seen any modern species in which all of the leaves are exactly like the fossil, but there are a considerable number of modern species with polymorphic leaves in which occasional leaves are very similar or identical with what I have called *Quercus perplexa*. I mention a number of these below, but do not think that they have anything more than a generic significance. For the most part all show considerable variation and tend to have entire leaves on old trees, and variously toothed margins on young trees or shoots—environments being apparently the guiding influence. I refer to species such as *wislizeni* DeCandolle, *oblongifolia* Torrey, *emoryi* Torrey, *arizonica* Sargent, *chrysolepis* Liebman, and *engelmanni* Greene. Doubtless other existing species from farther south could be enumerated.

It seems to me that, from the features shown and the considerations just mentioned, the present redetermination is abundantly justified.

[4] See for example the discussions of *Quercus mccanni*, *Quercus simulata*, and *Quercus treleasii* in U. S. Geol. Survey Prof. Paper 170: 36–37. 1931.

ETHNOBOTANY—*Mexican folk remedies of Chihuahua.*[1] ROBERT M. ZINGG, Department of Anthropology, University of Chicago. (Communicated by PAUL C. STANDLEY.)

This paper deals with the remedies used by the Mexicans of the lower and lower middle classes of the State of Chihuahua, in clear distinction from the primitive Tarahumara Indians, who furnish a few and the most important of them. While engaged in a study of the material culture of the Tarahumaras of the southern part of the State of Chihuahua, the writer had occasion to observe the prominent place in that culture occupied by medicinal plants, which will be described in another publication. These Indians collect several plants of such general esteem by their Mexican neighbors as to be worth the long foot-trip down from the distant Sierra to the capital city of Chihuahua, a distance of a hundred and twenty miles.

In general, it is quite apparent from the business of the *boticas*, that Mexicans are great believers in medicines; and none of them would be satisfied with a doctor's visit if he did not prescribe at least a half dozen different medicines, none of which does any harm. And so among the lower classes who can not afford the luxury of medical men and mixtures from the *botica*, a great profusion of medicinal herbs are relied upon, the virtue of which is largely that they, also, do not harm.

These data are not submitted as a contribution to medical knowledge; but they do involve more than mere curiosities in human behavior. Many of these medicinal plants show a far-reaching diffusion of technique in preparation for the identical ailment, rather than local and chance beliefs. *Jatropha* as a remedy for scratched eyes was carried by the Spaniards to the Philippines, where it gained the identical folk use.

The lore attaching to plants forms an important aspect of primitive and folk cultures which has not had adequate treatment by students of human culture. As Dr. Laufer says: "Cultivated plants are an essential element in the history of human ecology and civilization, and their study must be grasped in the sense of a cultural movement."

This paper is submitted in the thought that, though a meagre catalog of remedial plants, it is a slight addition to our knowledge; which, like Redfield's *Remedial Plants of Tepoxtlan*, will eventually build up a literature very valuable to the ethnobotanist who attacks the great problem of plants in Mexican culture.

[1] Received February 29, 1932.

Nothing could be more simple than gathering the material for such contributions. The present writer spent three hours in the special booth for medicinal plants in the public market of the city of Chihuahua, buying the different plants and noting on the envelopes containing them the local names and the uses, as well as the locality and the method of growing the plants.

For the value and coherence of this material, the reader is indebted to Mr. Paul C. Standley, of Field Museum of Natural History, who was generous enough of his wide knowledge of Mexican plants to identify and arrange these species, for which assistance the writer is deeply indebted.

Two wide-spread Mexican folk beliefs about animals may be mentioned. Injuries to the head, and headache, are thought to be caused by entrance of air through the ears. The bright feathers of the rare and magnificent giant woodpecker (*Campephilis imperialis*) are thought to be especially valuable as ear-muffs to prevent this. Consequently the Mexicans have practically exterminated this splendid bird in the Sierra Tarahumara. The well-known Tiger Salamander (*Ambystoma tigrinum*), which the Mexicans universally call by its Aztec name *axolote*, is common in the Sierra. Tarahumara in its larval form. In color it is spotted black and yellow, and is aquatic and has gills. The larval form is able to reproduce for generations and remains aquatic, though if the water disappears it becomes adult and terrestial. This ugly, though of course harmless, animal is the object of a widespread belief among the Mexicans, which the writer encountered in Chihuahua and New Mexico. It is thought to be especially dangerous to women, who are careful about nearing rivers, and would never sleep near them for fear of the animal entering their bodies.

There is a very widespread belief in Mexico about a fictitious plant which they call "quiebra muelas,"—molar-breakers. The belief was noted in Chihuahua. These plants are supposed to be very corrosive, and therefore dangerous to carry on the person. Ground up and placed on an aching tooth or the gums adjacent, they cause the tooth to be broken up and fall out.

POLYPODIACEAE

1. NOTHOLAENA SINUATA (Sw.) Kaulf.

Calahua del indio. Name is usually *calaguala.* This fern is esteemed as an excellent remedy. The decoction is drunk as a treatment of inflammation and bruises.

SELAGINELLACEAE

2. SELAGINELLA SP.
Flor de peña. This "resurrection plant" is brought by the Tarahumaras from the Sierra Madre to be sold to the Mexicans, by whom it is appreciated as a remedy for colic and indigestion.

EQUISETACEAE

3. EQUISETUM HIEMALE L.
Cola de caballo (Horse's tail). This horsetail or scouring rush is planted by the Mexicans in gardens near running water. Its decoction is drunk without sugar as a remedy for pains in the kidneys.

LILIACEAE

4. YUCCA SP.
Flor de palma. The flowers of the yucca plant are dried and brought considerable distances to Chihuahua, where they are sold. Their decoction is drunk as a remedy for colds.

AMARYLLIDACEAE

5. AGAVE SP.
Amole. The thickened roots of small agaves are collected by the Tarahumaras and brought down to the city of Chihuahua, for sale in the herb market. They are used like soap for washing clothes.

SAURURACEAE

6. ANEMOPSIS CALIFORNICA H. & A.
Hoja de babisa. This plant is grown in Mexican gardens along running water. The leaves and fleshy roots are boiled and the decoction used as a wash for sores and boils. It is the *yerba mansa* of southern California.

JUGLANDACEAE

7. JUGLANS MAJOR (Torr.) Heller
Nogal. From walnut leaves is prepared a beverage that is drunk like tea with sugar.

POLYGONACEAE

8. ERIOGONUM TENELLUM Torr.
Chuchaca. Mexicans bring this plant from the mountains to Chihuahua, where it is sold as a remedy. The plant is boiled and its decoction drunk as a purgative.

AMARANTHACEAE

9. AMARANTHUS PANICULATUS L.
Quelite morado. The decoction is drunk by pregnant women as a remedy against morning sickness.

LAURACEAE

10. LITSEA GLAUCESCENS H. B. K.
Laurel. The leaves of this laurel tree are very fragrant, and when boiled make a very tasty and refreshing tea, with sugar. The Tarahumaras, who appreciate it only as a medicine, especially since they do not have sugar, harvest considerable quantities of the leaves and bring them to Chihuahua, where they bring a good price.

The Mexicans not only appreciate laurel as a tea, for which they use it more commonly than the more expensive and less fragrant Asiatic teas, but they also attribute to laurel medicinal properties. They say that the decoction, drunk with sugar, is a remedy helpful for gas in the stomach.

ROSACEAE

11. PRUNUS CAPULI Cav.

Corteza de capulín. The wild cherry is a mountain tree, brought from the Sierra Madre by the Mexicans for sale. Its bark is boiled and the decoction drunk as a tea, without sugar, in the treatment of colds.

LEGUMINOSAE

12. PROSOPIS CHILENSIS (Mol.) Stuntz

Corteza de mezquite. The decoction of mesquite bark is drunk as a purgative and to clarify the urine.

13. ZORNIA DIPHYLLA (L.) Pers.

Hierba de víbora (Rattlesnake weed). This is esteemed by the Mexicans for colds and fevers. The decoction is drunk by children, though often adults mix it with their liquor (*sotol*).

ZYGOPHYLLACEAE

14. LARREA TRIDENTATA (DC.) Coville

Wame gobernadora. The characteristic "creosote bush" of the Chihuahuan desert. The branches are picked from the fields, and saved for their medicinal uses. They are fried with lard and used hot as a poultice in the treatment of rheumatism.

RUTACEAE

15. CITRUS LIMONIA Osbeck.

Limón. Lemon peel is ground with the seed of the avocado (*Persea americana* Mill.) and used warm as a poultice.

Orange peel is burned in charcoal braziers as a preventive of headache.

16. RUTA CHALEPENSIS L.

Ruda. Grown in Mexican gardens for the use of its decoction for "air in the intestines and stomach." Rue is a European plant.

Ruta graveolens: "Its odor is very strong, its taste sharp and bitter. Contains a glucoside, rutine, and an essential oil to which it owes its physiological properties. . . . It exercises locally an irritating action on the skin and mucous membrane. Used internally it can cause gastro-enteritic accidents with spasms and convulsions. It is employed as a stimulant to uterine contractions and against hemorrhages. Only indirectly it produces abortions." (*Farmacopea Latino-Americana*, p. 565.)

EUPHORBIACEAE

17. CROTON MONANTHOGYNUS Michx.

Encinilla. This low herb of the spurge family is cultivated in Mexican gardens, or the plants are gathered on the plains. It is boiled and "drunk with sugar as a cordial, when one cannot drink coffee."

18. EUPHORBIA SP.

Hierba de la golondrina. A prostrate herb, gathered from the fields and used by the Mexicans in treatments of boils and ulcers. The decoction is used as a wash; and then part of the dry leaves are ground up and dusted on

the cleaned lesion on the skin. Throughout Mexico and the southwestern United States similar spurges have high repute as a remedy for rattlesnake bites.

MALVACEAE

19. MALVA PARVIFLORA L.

Malva. This mallow is commonly planted in gardens by Mexicans, or bought, its decoction being appreciated by women as a douche.

LOGANIACEAE

20. BUDDLEIA SCORDIOIDES H. B. K.

Escobilla. A pale, woolly shrub with flowers in spherical heads. The decoction is drunk as a purgative.

APOCYNACEAE

21. MACROSIPHONIA HYPOLEUCA (Benth.) Muell.

Rosa de San Pedro. The Mexicans bring this plant from the mountains. It is a small shrub with beautiful, large, white flowers. Its decoction is esteemed for bathing infected eyes.

CONVOLVULACEAE

22. DICHONDRA ARGENTEA Willd.

Orejuela de ratón (Mouse's ear). The plant is a diminutive creeping herb with silvery, kidney-shaped leaves. The decoction is drunk as a remedy for jaundice. It is thought also an excellent remedy for "frights," to which are attributed many ills among the Mexican folk as well as the Indians.

HYDROPHYLLACEAE

23. NAMA UNDULATUM H. B. K.

Ventosidad. This plant is grown in Mexican gardens for sale as a folk remedy. Its decoction is drunk for the common digestive disorder of gas on the stomach. Of its efficacy the herb vender told me that when so taken, "then the balloon on the inside goes down." The Mexican name for the plant, *ventosidad*, means "windiness" or "gas on the stomach."

VERBENACEAE

24. LIPPIA BERLANDIERI Schauer.

Orégano. The dry leaves of this aromatic shrub are pulverized and sprinkled on food as a seasoning. The decoction is drunk as a remedy for colds.

LABIATAE

25. MENTHA SPICATA L. (Spearmint)

Hierbabuena. The plant is commonly grown in gardens. The decoction is drunk for indigestion.

"It has stimulating properties; it is an antispasmodic, being generally administered as an infusion. It is much used in folk medicine in this way." (*Farmacopea Latino-Americana*, p. 393).

SOLANACEAE

26. SOLANUM ELAEAGNIFOLIUM Cav.

Trompillo. A field weed. The berries are used to curdle milk after boiling, in the Mexican cheese-making technique. The plant bears the same name in New Mexico and western Texas, where it is employed for the same purpose.

PLANTAGINACEAE

27. PLANTAGO MAJOR L.

Semilla de llantén. Masorcita de llantén. The seeds of plantain are planted in Mexican gardens because of the medicinal use of the plant, which is commonly boiled and its decoction drunk as a remedy for dysentery or diarrhea.

"*Semilla de llantén. Mazorquita de llantén.* The greater part of these contain in their seeds inverted sugar emulsion; also a glucoside that can be crystallized, identical with the aucubine of *Aucuba japonica*. The whole plant is used as an astringent, and its juice is employed in folk medicine as a febrifuge, and against the bites of rattlesnakes (?!). It does not give results." (*Farmacopea Latino-Americana*, p. 432).

COMPOSITAE

28. CHRYSACTINIA MEXICANA Gray

Damiana. Hierba de San Nicolás. The Mexican women esteem this small aromatic shrub, which they boil and drink as a tea in the belief that it is helpful during pregnancy.

"Various extracts from this plant have been given to animals, and result non-tonic and have no physical action(!). The decoction and tincture of the plant have been applied to see if the plant had any tonic effects. The results so far have been nil, but the number of experiments to date has not been sufficient to prove whether or not it exercises any tonic action." (*Farmacopea Latino-Americana*, p. 454).

29. ARTEMISIA MEXICANA Willd.

Istafiate. This is a common Mexican herb remedy, the decoction being drunk by children for colic. Adults sometimes drink it in liquor. The plant has a bitter flavor.

"It is used in Mexico as a substitute for true *ajenjo* (*Artemisia Absinthium*; from which absinthe is made) . . . . since it has very similar properties. It contains an essence and santonine, the latter in the inflorescences to 1.24%.

"The tincture does not produce any action local or general, and is not a tonic. It retards the action of the gastric juice, and slows up digestion.

"Its essence paralyzes the movements of the frog, leaving its sensibility intact, however. It appears less poisonous than the essence obtained from *Artemisia Absinthium*. The plant may be employed as an anthelmintic, and to modify sensibility. There is a common folk belief that it works as a stomachic. In some cases it appears to operate as a light aperitive." (*Farmacopea Latino-Amerciana*, pp. 306–7).

30. BRICKELLIA SP.

Pestón. Gathered from the fields and saved to boil, the decoction being used as a purgative.

31. CIRSIUM UNDULATUM (Nutt.) Spreng.

Cardo santo. The decoction of this native thistle is used for bathing swellings.

32. DYSSODIA ACEROSA DC.

Hierba del arriero. This is an aromatic field weed which is dried, and its decoction drunk as a purgative.

33. FLOURENSIA CERNUA DC.

Hojasén. This plant is a resinous shrub, that is gathered from the fields, and a small amount of the decoction drunk as a purgative. It is so strong in action that only a little is taken.

34. GNAPHALIUM WRIGHTII Gray

Manzanilla del río. This is a woolly herb from the Sierra Madre which is brought to Chihuahua by the Mexicans. It finds a sale, since they think its decoction good for colds. It may also be used as a wash for sores and ulcers.

35. MATRICARIA COURRANTIANA DC.

Manzanilla de Castilla. This small white daisy is a favorite plant in Mexican gardens, its decoction being used as a hot douche.

M. Chamomilla L. (Compositae). "In the markets the heads are found for sale, with more than 5% of the stalks and foreign substances. . . . The odor of the plant is aromatic and agreeable, its taste aromatic and sour. Contains a volatile acid dark blue in color which is soluble in alcohol. It is a tonic and stimulant to a dose of 16 grains. In large quantity it is an emetic." (*Farmacopea Latino-Americana*, p. 348).

36. TAGETES ERECTA L.

Flor de muerto. Sempual. The garden marigold is grown in Mexican gardens for use and sale as a medicine, as well as for ornament. Its decoction is thought to be an excellent remedy for diarrhea.

37. TAGETES LUCIDA Cav.

Hierba anís. The decoction of this strong-scented plant is drunk for colic and wind on the stomach. It is often taken with honey.

"This is one of the most widely used medicinal plants of western Mexico. The species has a wide distribution. The plants gathered by the country people are made up in small bundles and dried, and then put away for use. It is made into a tea, and supposed to have numerous virtues, including efficacy against scorpion bites, fever, ague, etc.

"Dr. Palmer says that in Colima it is made into an insect powder. This is the same plant as the Santa María of the Cora Indians." (Rose: Notes on the Useful Plants of Mexico, p. 231.)

38. TAGETES MICRANTHA Cav.

Anisillo. A small, weedy, strong-scented herb, whose decoction is drunk for stomach trouble.

39. ZINNIA GRANDIFLORA Nutt.

Cinco llagas. A weed picked from the fields, a relative of the garden zinnia. Its decoction is drunk as an astringent for diarrhea.

40. CACALIA DECOMPOSITA Gray

Matarique (Mex.); *pi-tcá-wi* (Tar.) This is one of the most esteemed medicinal plants furnished by the Tarahumara Indians of the barrancas to the Mexicans of Chihuahua. There they consider it a cure for diabetes, and pay the Indians a good price for it. The plant is listed in the *Farmacopea Latino-Americana*, which supplies these data:

"It is a plant of a meter in height, flowers in September and October. The root is aromatic and presents, upon breaking, an abundant zone of yellow resin. It comes from the mountains of Santa Cruz (Sonora), and Mapula (Chihuahua).

"The root is employed, since it contains two resins, essential oil, glucoside, tannic acid, and grease. The hydro-alcoholic preparation of the root acts to paralyze the motor system of the striated muscles, and the heart; it produces a light anaesthesia by its local peripheral action.

"The tincture favors scarification of the tissues when applied on ulcers, wounds, etc., by its antiseptic action owing to a coating that it forms.

"Given internally, it produces emetic and cathartic effects, and general retardation, but on occasions its use has caused chloroform accidents of a grave nature.

"Rheumatic pains, especially of the joints, as well as neuralgic pains are calmed by its application in *loco dolente*. The rapid scarification of ulcers and wounds is favored by washing them with a mixture of the tincture in water, or by the tincture alone.

"In the hospital of San Andrés they used the same tincture as a purgative, but the results were variable; with two doses up to 100 grams chloroformic accidents occurred involving the heart. With two doses of 30 grams no purgative effects were obtained, and its use only succeeded in calming indigestion and headache.

"The ordinary preparation is the tincture of the root (one part of the root to five of alcohol or an 80% solution). It is administered internally in doses of 30–100 grams with variable effects. Externally it is applied as a sedative of pain by rubbing the *locum dolentem*. As a vulnerary it is mixed with equal parts of water."

This plant, after being pounded and boiled for fifteen minutes, is used by the Tarahumaras as an internal remedy for colds. Its properties as a vulnerary are understood by them, as they wash wounds in its decoction. Its paralytic effects on the central nervous system are utilized by the Tarahumaras, whom I saw using it as a fish poison, in water retained by damming.

The purgative property of the plant is also known to the Tarahumaras. A bundle of the roots that can be encircled by the thumb and finger is ground on the metate. This is drunk with plenty of warm water. The Indians say that it is a very drastic purgative, and that its action must be stopped by eating cold *atole* (corn mush).

ZOOLOGY.—*A new Pinnotherid crab from the Hawaiian Islands.*[1]

MARY J. RATHBUN, United States National Museum.

Dr. Charles H. Edmondson of the Bernice P. Bishop Museum has submitted for report a new form of the curious genus *Aphanodactylus* described by Tesch.[2]

Aphanodactylus edmondsoni, new species

Compared to *A. sibogae* Tesch, carapace narrower, 9.6 x 16.2 mm., as against 6 x 11.25. Fronto-orbital distance greater, 7.6 mm., or more than 4/10 of carapace width of *sibogae*. Posterior width 8.6 mm., instead of 1–1/2 x fronto-orbital distance. Antennal flagellum not 2 or 3-jointed, but 10-jointed, terminating in a slender seta. Palp of maxilliped long, overreaching a little the merus-ischium suture. Merus-ischium narrower than in *sibogae*; inner margin of merus nearly straight instead of convex. Merus of ambulatory legs 1–3 armed below with a large triangular spine-tipped tooth at distal third; the tooth of third right leg only is bispinose at tip, apparently an abnormality. Merus of last leg has two very small spines on posterior margin. Carpus of ambulatory legs tapering distally (not narrowed in female of *A. sibogae*). Carpus-propodus hairy on both margins, merus hairy below.

[1] Published with the permission of the Secretary of the Smithsonian Institution. Received February 19, 1932.

[2] Decapoda Brachyura Siboga Exped., Mono. XXXIX c[1], 1918, p. 283, pl. 18, fig. 2.

Fine hair borders arm, inner angle of wrist, prehensile margins of fingers; a small patch at middle of inner surface of palm; long hair on lower margin of carapace, margin of abdomen and surface of maxilliped; a row of short thin hair above edge of rostrum.

Type-locality.—Oahu, from worm tube, Nov. 27, 1931. Holotype in Bishop Museum.

ZOOLOGY.—*A new species of* Cyclops *from the Philippine Islands.*[1]

C. DWIGHT MARSH, United States National Museum.

The following description is of the mature female.

Cyclops philippinensis, new species

The first segment of the cephalothorax is considerably longer than the remaining part.

The abdomen, Fig. 1, is about two-thirds as long as the cephalothorax. The first segment about equals in length the three following, and its greatest breadth about equals its length. The second, third, and fourth segments gradually diminish in length, the fourth being about one-half as long as the second. The posterior borders of the abdominal segments are very finely dentate.

The branches of the furca about equal the combined length of the third and fourth segments. The lateral setae are situated at about two-thirds the length of the furca. Of the terminal setae, Fig. 3, the first and fourth are nearly equal in length, the fourth being slightly longer. The third seta is longer than the second and is somewhat more than four times the length of the fourth.

The segments of the abdomen and furca are covered with minute pellucid dots. These dots are arranged in transverse lines on the first segment and sometimes on the other segments. The dots are not projections from the surface, and so far as the author knows, are peculiar to this species.

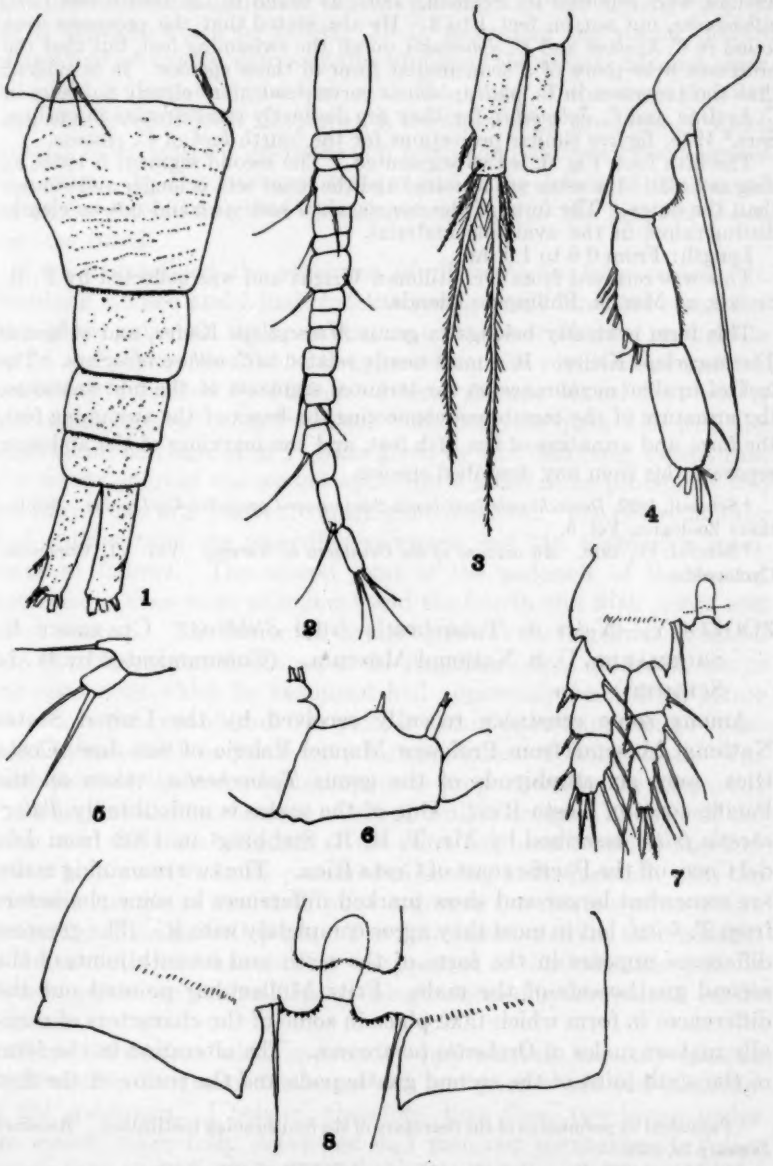
The first antennae, Fig. 2, about equal in length the cephalothorax. They have seventeen segments and there are no hyaline lamellae on the sixteenth and seventeenth segments. In the second antennae, Fig. 4, the third and fourth segments are about equal in length. The lower border of the second segment of the posterior maxillipede has crenulations, Fig. 5, resembling those found in *C. leuckarti*.

The spinous armature of the terminal segments of the exopods of the swimming feet is represented by the formula 2, 3, 3, 3. In the fourth feet, Fig. 7, the terminal spines of the third segment of the endopod are nearly equal in length.

The membrane connecting the bases of the swimming feet has two rounded processes, each armed with a number of dentations, Figs. 7 and 8. Such pro-

[1] Received February 9, 1932.

Fig. 1. *Cyclops philippinensis*: abdomen of female, x 223. Fig. 2. *Cyclops philippinensis*: first antennae of female, x 223. Fig. 3. *Cyclops philippinensis*: furca and furcal setae of female, x 223. Fig. 4. *Cyclops philippinensis*: second antenna, x 438. Fig. 5. *Cyclops philippinensis*: fifth foot, x 438. Fig. 6. *Cyclops philippinensis*: second segment of posterior maxillipede, x 438. Fig. 7. *Cyclops philippinensis*: fourth foot, x 223. Fig. 8. *Cyclops philippinensis*: connecting membrane of fourth feet, x 438.



Figs. 1–8. *Cyclops philippinensis.* For explanation see page 182.

jections were reported by Schmeil,[2] 1892, as found in the fourth feet of *C. oithonoides*, but not on feet 1 to 3. He also stated that the processes were found in *C. hyalina* and *C. dybowskii* on all the swimming feet, but that the processes were more of a semicircular form in these species. It is evident that the processes in *C. philippinensis* correspond more closely to those in *C. hyalina* and *C. dybowskii*, for they are distinctly semi-circular in outline. Sars,[3] 1918, figures similar projections for the fourth feet of *C. crassus*.

The fifth foot, Fig. 5, is two segmented. The second segment is twice as long as broad: the setae are terminal and the inner seta is longer and stouter than the outer. The form of the *receptaculum seminis* could not be clearly distinguished in the available material.

Length: From 0.9 to 1.0 mm.

This was received from Dr. Stillman Wright and was collected by P. B. Sivikis, at Manila, Philippine Islands.

This form evidently belongs to genus *Mesocyclops* Kiefer, and subgenus *Thermocyclops* Kiefer. It is most nearly related to *C. oithonoides* Sars. The lack of hyaline membranes on the terminal segments of the first antennae, the armature of the membrane connecting the bases of the swimming feet, the form and armature of the fifth feet, and the markings of the abdomen separate this from any described species.

[2] Schmeil, 1892, *Deutschlands freilebende Süsswasser-Copepoden-Cyclopidae*. Bibliotheca Zoologica, Vol. 6.

[3] Sars, G. O., 1918. *An account of the Crustacea of Norway*. Vol. VI, Copepoda, Cyclopoida.

ZOOLOGY.—*Notes on* Talorchestia fritzi *Stebbing*.[1] CLARENCE R. SHOEMAKER, U. S. National Museum. (Communicated by W. L. SCHMITT.)

Among some crustacea recently received by the United States National Museum from Professor Manuel Valerio of San José, Costa Rica, were six amphipods of the genus *Talorchestia*, taken on the Pacific coast of Costa Rica. One of the males is undoubtedly *Talorchestia fritzi* described by Mr. T. R. R. Stebbing[2] in 1903 from Isla del Coco, off the Pacific coast of Costa Rica. The two remaining males are somewhat larger and show marked differences in some characters from *T. fritzi*, but in most they agree completely with it. The greatest difference appears in the form of the sixth and seventh joints of the second gnathopods of the male. Fritz Müller[3] has pointed out the differences in form which take place in some of the characters of sexually mature males of *Orchestia tucurauna*. The alteration in the form of the sixth joint of the second gnathopods and the fusion of the first

[1] Published by permission of the Secretary of the Smithsonian Institution. Received January 29, 1932.

[2] Stebbing, 1903, Proc. U. S. Nat. Mus., vol. XXVI, p. 925, pl. 60.

[3] Fritz Müller, *Facts and Arguments for Darwin*, London, 1869, pp. 79–80.

few joints of the flagellum of the second antennae are among the principal changes which he noted. In *O. tucurauna* the young mature males had an evenly convex palm which, as the animal became older, acquired a deep emargination near the hinge of the seventh joint, and the seventh joint developed a corresponding prominence which exactly fitted into the emargination when the joint was closed against the palm. In the youngest mature males the joints of the second antennae were all free, but as maturity advanced the first few joints became fused.

I have examined the specimen of *Talorchestia fritzi* which Mr. Stebbing studied and I find that the young males have the emargination of the palm and the protuberance on the seventh joint so slight as to be scarcely noticeable, thus approaching the condition of uniform convexity described by Müller. I have already stated that one of the males received from Professor Valerio agrees quite well with the description and figures of *T. fritzi* given by Mr. Stebbing, except that the second joint of the second antennae is much more prominent and the fourth and fifth joints are much more massive. The two remaining males differ from the preceding specimen and Mr. Stebbing's specimens as follows. The second joint of the peduncle of the second antennae is even more prominent and the fourth and fifth joints still more massive. The first seven or eight joints of the flagellum are fused. Mr. Stebbing states that none of the flageilum joints are fused, but as the specimens which he examined had apparently been dried before they were put into alcohol this point is rather uncertain, though to me the first three or four joints have the appearance of being fused. The sixth joint of the second gnathopods is proportionally the same, but the emargination has become enlarged until it occupies about half the palm, and the remaining half of the palm has been crowded together into a high evenly convex prominence having at its junction with the posterior margin of the sixth joint a groove for the reception of the extremity of the seventh joint. The protuberance on the inner margin of the seventh joint has entirely disappeared so that when the joint is closed against the palm a large opening is formed by the palmar emargination.

These differences, while apparently very marked, are only such as could readily be due to the larger size and greater age and maturity of the specimens. I believe, therefore, that these two larger males are merely more fully developed and matured specimens of *Talorchestia fritzi* Stebbing. In the Amphipoda development is frequently

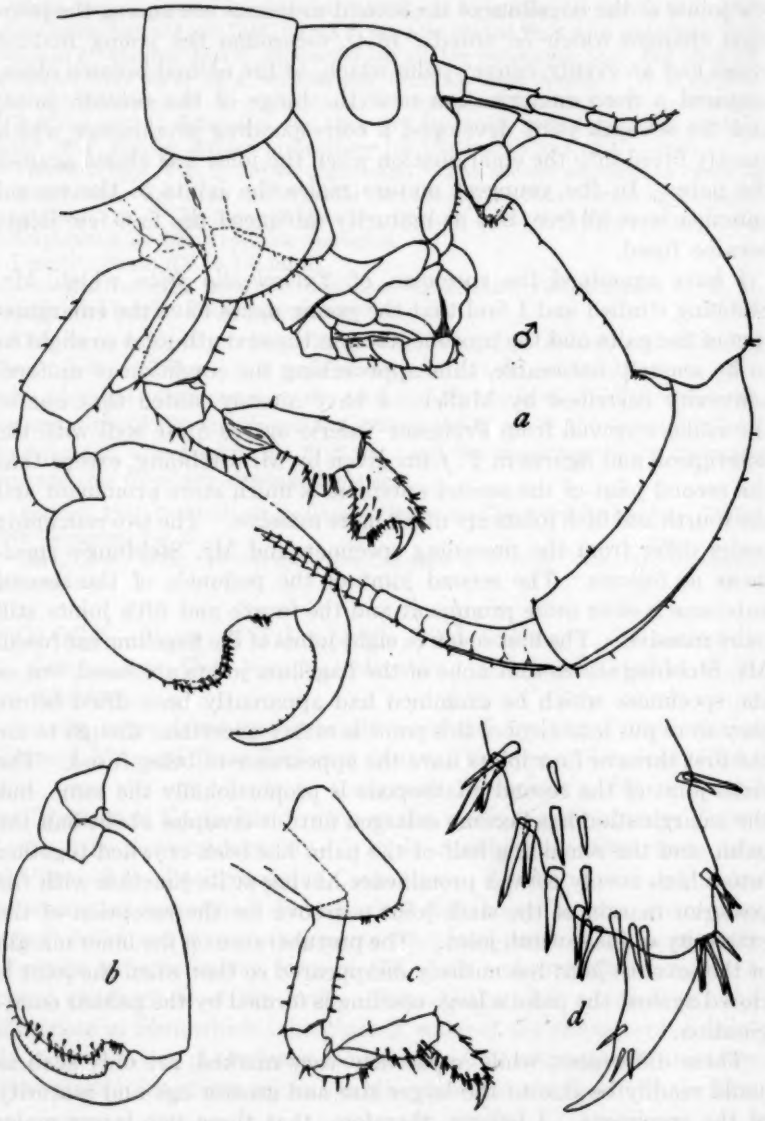


Fig. 1.—*Talorchestia fritzi* Stebbing. *a*, Head, antennae, and gnathopods of fully developed male. *b*, Gnathopod 2, left, inside view of young male. *c*, Gnathopod 1 of female. *d*, Extremity of gnathopod 1 of female much enlarged.

accompanied by marked changes in the form of the second gnathopod of the male.

Although Mr. Stebbing noted the general resemblance in the second gnathopods of *T. fritzi* to those of *Orchestia tucurauna* he believed that there was enough difference in other characters to distinguish them as separate species. It is not possible to determine from Fritz Müller's description or figures whether his species is an *Orchestia* or a *Talorchestia*, so that with further knowledge of these two species they may well prove to be one and the same. The first gnathopods of the females of these specimens from Professor Valerio approach more decidedly a subchelate structure than is shown by Mr. Stebbing in his figure. I have examined the females which he studied and find that the specimens show somewhat more of an approach to the subchelate structure than he has indicated. The dividing line between *Orchestia* and *Talorchestia* is so very hazy that at times it is difficult to decide into which of these two genera a species should be placed. For the present *T. fritzi* had best be left in the genus *Talorchestia*.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

BIOLOGICAL SOCIETY

765TH MEETING

The 765th meeting was held in the new assembly hall of the Cosmos Club 17 October 1931 at 8.10 p.m., with President JACKSON in the chair and 33 persons present.

FRANK THONE mentioned the observation of a partly albino robin recently near the National Academy building.

E. P. WALKER commented on Dr. W. M. MANN's return with specimens from British Guiana. He also stated that both the lowland and mountain forms of gorilla are on exhibition at the Zoological Park.

I. N. HOFFMAN stated that Mr. DENLY has raised this summer several rare species of pheasant, including Java peafowl and Elliot pheasant. He has about 25 species in captivity.

The regular program was as follows:

WATSON DAVIS: *Some recent biological expeditions.*—The speaker has record of about 60 biological expeditions of greater or less importance afield throughout the world in 1931.

FRANK THONE: *New books in biology.*—The speaker exhibited and commented briefly on a considerable number of new books.

S. F. BLAKE, *Recording Secretary*

766TH MEETING

The 766th meeting was held in the new assembly hall of the Cosmos Club 31 October 1931 at 8.05 p.m., with President JACKSON in the chair and 48 persons present. New member elected: W. O. EMERY.

The following resolution was adopted:

Whereas, the Biological Society of Washington has learned with profound regret of the death of Dr. J. W. GIDLEY, an ex-president of the society, and Assistant Curator of Fossil Mammals in the U. S. National Museum, therefore be it

Resolved, That this Society desires to place on record its sorrow at the loss of a valued member, and its appreciation of his ability as a scientist, and of his character and worth as a man.

Resolved, further, that this resolution be spread upon the minutes of the society, and that a copy be transmitted by the Secretary to the bereaved family.

E. P. WALKER mentioned the new check list of birds recently issued by the American Ornithologists' Union.

The regular program was as follows:

T. S. PALMER: *The 49th Annual Meeting of the American Ornithologists' Union at Detroit, and the recent Audubon Society Meeting.*—JOSEPH GRINNELL was reelected president, A. C. BENT and J. H. FLEMING vice-presidents and W. L. MCATEE treasurer of the American Ornithologists' Union. Mrs. FLORENCE MERRIAM BAILEY was awarded the Brewster medal of the Union for her recently published work "Birds of New Mexico." The next annual meeting of the Union is to be at Quebec in October, 1932.

LOUIS RADCLIFFE: *A recent trip through the Upper Mississippi River Wild Life and Fish Refuge.*—The speaker described a trip up the river from Dubuque, Iowa to Lake Pepin, Minnesota, with special mention of the effect of floods, the maintenance of a nine foot channel, and the fish rescue work of the Bureau of Fisheries.

M. M. ELLIS: *Biological aspects of the inland river situation (illustrated).*—The speaker outlined the destructive effect on aquatic life of river pollution through municipal and industrial waste and erosion silt. Acid products from industrial plants accumulate behind dams and even attack the metal parts of boats.

E. A. GOLDMAN, *Recording Secretary, Pro Tem.*

767TH MEETING

The 767th meeting was held in the new assembly hall of the Cosmos Club 14 November 1931, at 8.10 p.m., with President JACKSON in the chair and 68 persons present.

E. P. WALKER reported that several silver gulls are setting on eggs in the Zoological Park and that some nests hold downy young, showing a remarkably prolonged nesting season.

FRANK THONE exhibited several recently published books, including Ditmars' "Snakes of the world," and Edgerton's "Elephant-lore of the Hindus."

The regular program was a *Symposium on the effects of drought upon plant and animal life*, with the following speakers:

M. B. WAITE: *Plants.*—The drought of 1930 was the severest ever known in this vicinity. It produced little effect upon the early spring flowers, but its effects became evident in late spring and summer. The steadiness of the drought resulted in little external injury such as leaf scald and tip burn. Annuals were more affected than perennials. In 1930 very little sugar corn was raised in this region, most of it having to be cut for fodder owing to its poor development. Melons and squashes did fairly well, as did forest trees and shrubs. The shallow-rooted flowering dogwood suffered most among native trees. The grass in meadows and pastures suffered severely and some of it was killed. Peaches throve, apples suffered greatly, and pears were intermediate. There was a poor development of parasitic and fleshy

fungi. In 1931 there was a tremendous development of annual weeds. Tulips and other bulbous plants and iris did well in 1931, but gladiolus and lilies did poorly. There was a great corn and tobacco crop in 1931. Peaches, oaks, and other trees were a couple of weeks late in ripening fruit and coloring their leaves in 1931, perhaps due to excess of nitrates in the soil resulting from continued lack of rain.

C. R. LUCAS: *Fish.*—Many game fish, particularly trout, bass, and catfish, suffered severely from the heating of waters and abnormal sewage conditions due to drought. Losses were most severe in the central and southern Mississippi River region and in West Virginia. A great deal of work in salvaging fish from drying waters was carried on by the Bureau of Fisheries. A great deal of restocking and replacement will be necessary.

W. B. BELL: *Birds and mammals.*—Birds and mammals have greater adaptability and power of locomotion than some of the lower groups and tend to concentrate in places where water is available in times of drought. The smaller mammals vary their food to obtain more moisture in such a way as to do more damage than at other times. The number and size of litters are reduced. The effects of the drought on waterfowl in Canada depended greatly on topography. In the southern parts of Alberta and Saskatchewan, rolling country with depressions containing water, great areas became perfectly dry and a tremendous amount of injury was done to young birds by these conditions, as well as by the fact that farmers carried cultivation into these drying areas and ruined them as breeding places for birds.

J. A. HYSLOP: *Insects.*—The effects of drought on insects must be distinguished carefully from those of other factors. Species favorably affected by drought carried over into 1931 in large numbers; those injured in 1930 have in some cases come back vigorously in 1931. The net result is that 1931 was a year of exceptional insect injury. Aphids, Oriental fruit moth, and Mexican bean beetle suffered in 1930 and were scarce in the spring of 1931 but increased rapidly in the fall. Chinch bug and leafhoppers increased greatly in both years, as did mosquitoes through the change of streams to puddles. Grasshoppers did little damage in the spring of 1930, greater damage in the summer and fall, and very great damage in 1931 in the Great Plains and Great Basin. Cutworms and army worms were worse in 1931.

M. K. BRADY: *Amphibians.*—In general, amphibians breeding in temporary spring ditches or pools suffered greatly, in part through drying up before metamorphosis, in part due to greater injury done by birds and other enemies. Species breeding in permanent waters came through much better. Among closely related forms the effects of the drought were sometimes very different. Species belonging to the Coastal plain suffered most. The late breeders suffered more in 1930 than in 1931. Swamp tree frog, leopard frog, green frog, bullfrog, Fowler's toad, newt, and marbled salamander were not greatly affected by the drought. Spring peeper, American toad, pickerel frog, common tree frog, Jefferson and spotted salamanders suffered much. The red-backed salamander was greatly reduced in numbers and the four-toed salamander was nearly exterminated.

Discussed by E. A. GOLDMAN, LOUIS RADCLIFFE, E. P. WALKER, I. N. HOFFMAN, and W. T. SWINGLE. Mr. GOLDMAN described the effects of drought as observed in Lower California and Texas, and stated that in his opinion a continuous drought might exterminate very local species. Mr. RADCLIFFE stated that on account of the concentration of fish life, predators could cause great damage. Young fish suffered from drying up of the protective vegetation on borders of water. The influx of salt or brackish waters

frequently killed whole populations outright. Mr. HOFFMAN spoke of great mortality observed among white birch, dogwood, and hemlock in local parks.

768TH MEETING

The 768th meeting was held in the new assembly hall of the Cosmos Club 28 November 1931, at 8.10 p.m., with President JACKSON in the chair and 110 persons present. New members elected: E. B. CHAMBERLAIN, R. H. COLEMAN, J. K. DOUTT, and T. H. WHITCROFT.

FRANK THONE exhibited several new books, including Bentley and Humphreys' "Snow crystals."

F. C. LINCOLN stated that he had received a telephone communication relating to the presence of downy young in the nest of a Barn Owl in Ohio during the month.

The regular program was as follows:

T. S. PALMER: *Meeting in honor of the anniversary of William Henry Flower (1831-1899)*.—Flower was born in Stratford, England, and was from an early age interested in natural history. He graduated in medicine, was invalided home from the Crimean War, and became Curator of the Museum of the Royal College of Surgeons and Hunterian Professor of Comparative Anatomy. He became Director of the British Museum of Natural History in 1884. He was very accurate and painstaking in his work and insisted on making knowledge accessible to the people. He was the founder of the modern methods of museum exhibition.

H. C. BRYANT: *National parks as sanctuaries for wild life (illustrated)*.—The speaker showed plain and color slides of some of the more interesting animals and plants found in the national parks, and gave figures on the number of larger mammals. There are about 12000 elk, over 13000 mountain sheep, 1700 black bear, 250 grizzly bear, 25000 mule deer, 2000 white-tail deer, and 3000 black-tail deer in western parks. Difficulties in administration are due mainly to four causes: (1) to migration of animals outside park limits after severe storms, and subsequent shooting; (2) the spread of disease from domestic to wild animals, an increasing problem; (3) the naturalization of plants, such as foxtail grass, and animals, such as the opossum in Sequoia National Park, which do harm to the native fauna and flora; (4) and to artificial feeding during the winter and at other times, which is of doubtful value to the herds and to the bears. In conclusion, he showed a reel of animal life in Yellowstone Park.

I. N. HOFFMANN: *Natural features in Washington city parks (illustrated)*.—The speaker mentioned a number of the more interesting trees found in Washington parks, and exhibited pictures of park scenery.

769TH MEETING

The 769th meeting was held in the New Assembly Hall of the Cosmos Club 12 December 1931 at 8:10 p.m. with President JACKSON in the chair and 62 persons present. New members elected: CORABEL BIEN, R. W. HARNED.

T. S. PALMER mentioned that W. H. FLOWER, about whom he spoke at the last meeting, was elected a corresponding member of the Biological Society on 8 February 1884, six weeks before he took the office of Director of the British Museum.

The regular program was as follows:

HERBERT FRIEDMAN: *Social weavers of South Africa (illustrated)*.—The social weaver (*Philetairus socius*) inhabits the semi-arid plains country of

southern Africa. The members of a whole flock unite in building a community nest, each pair having a nest inside it on the under side, entered by a vertical hole. In the region studied, it nests in Acacia trees, and farther west in aloes. A pigmy falcon sometimes nests in one of the holes, but appears to live on good terms with the weavers, and the author never found feathers of the weaver in the stomachs of the falcons. Although the white settlers usually protect the nests, the natives try to destroy them by burning, because of their fear of certain snakes which are frequently found on the nests and sometimes drop down on passers-by. The author described his experiences in bringing back to the American Museum of New York a complete nest of these birds. The social weaver builds a larger nest in proportion to its size than any other bird in the world and inhabits it for years. It sometimes reaches fifteen feet or more in diameter.

HORACE RICHARDS: *Biological studies on the New Jersey coast (illustrated).*—The speaker described his work in the study and collection of lower invertebrates off the New Jersey coast and Delaware Bay, illustrating it with slides of many of the animals observed.—In discussion, T. S. PALMER pointed out that whaling was formerly an important industry in Delaware Bay and off the New Jersey coast, and that a blackfish had actually been caught many years ago in the Delaware River at Camden, although this record had been discredited by Dr. True.

S. F. BLAKE, *Recording Secretary*

SCIENTIFIC NOTES AND NEWS

J. W. GREEN of the Department of Terrestrial Magnetism, Carnegie Institution of Washington, arrived at Rio de Janeiro January 3 and left January 28 after making comparisons with magnetic instruments at Vassouras.

EARL HANSON of the same Department is making an extensive magnetic survey in the northern part of South America. He has already ascended the Orinoco and crossed over to the Rio Negro river.

A narrative by J. HARLAND PAUL, entitled "The Last Cruise of the *Carnegie*" has just been published. The scientific work is described in popular style. The book is dedicated to Capt. J. P. AULT who was a member of the Academy, and who lost his life with the vessel.

The Carnegie Institution of Washington lectures on the magnetic field of the Earth and the Earth's atmosphere were given on the evenings of March 8, 15, and 22, by Messrs. FLEMING, KENNELLY, and BARTELS, at the Administration Building of the Institution.

Announcement has been made by the Carnegie Institution of Washington that Messrs. TUVE, HAFSTAD, and DAHL of the Department of Terrestrial Magnetism, using high-voltage tubes, have succeeded in observing and photographing the paths made by high-speed protons. They have also succeeded in making preliminary measurements of the distance the protons will travel in air, thereby obtaining a check on the law which governs their paths.

The fourteenth annual meeting of the American Society of Mammalogists is to be held in Washington May 3 to 7, 1932, the sessions for the presentation of papers, discussion, and business to convene at the National Museum. The

local committee on arrangements consists of Dr. W. M. MANN, Director of the National Zoological Park; Dr. REMINGTON KELLOGG, Assistant Curator of the Division of Mammals; ERNEST P. WALKER, Assistant Director of the National Zoological Park; and WALTER C. HENDERSON and Dr. H. H. T. JACKSON, of the Bureau of Biological Survey. According to the plans of this committee, a combined reception, smoker, and movies will be held on Wednesday evening, May 4, and the annual dinner on Thursday evening, May 5. On Saturday, there will be a luncheon at the National Zoological Park, with a tour of the zoo in the afternoon.

Dr. C. LEWIS GAZIN, of Pasadena, Calif., recently appointed Assistant Curator in the Division of Vertebrate Paleontology in the National Museum, took up his duties March 1. Doctor GAZIN is a graduate of the California Institute of Technology where he also pursued his postgraduate studies. After leaving college he joined the United States Geological Survey, doing geological work in California and other western states. He will take over the duties of the late Dr. J. W. GIDLEY.

NOTICE TO READERS OF THE JOURNAL

A special committee has been appointed by the president of the Academy to study the problems of publication of the Journal of the Washington Academy of Sciences. The chairman is HARVEY L. CURTIS, Bureau of Standards, and the other members, C. W. COOKE, E. A. GOLDMAN, H. B. HUMPHREY, and R. S. MCBRIDE. The committee is considering first the fundamental question of the major objectives which are now, or should be, served by this Journal. The committee desires to determine the wishes of the membership of the Academy and of others who subscribe for the Journal as to the relative importance of different parts or functions, the desirable frequency of publication, and other fundamental matters of policy. The committee will welcome comments on any phase of Journal policy; these should be addressed to the chairman by letter at an early date.